articulation, upon which subject Mr. Bell has bestowed a vast deal of time and study. But a limited number of teachers in training can be accommodated, and the opportunity is doubtless one which will be eagerly sought.

The national museum, Mr. Barnum, and the big elephant Jumbo, have all received a good deal of public notice arising from the singular death of the gigantic and lamented beast. The public was at first assured that the bones of this creature, fated to disturb two continents, were to rest in the national depository, although it was stated that the stuffed skin was to adorn the collection of a New England college. Recent information, however, seems to indicate that Mr. Barnum has awakened to the fact that he now has two Jumbos, instead of one, and that both may continue to be sources of profit for some time to come as parts of one or two travelling 'aggregations.' There is little doubt but that a year or two of this sort of an existence would greatly diminish the value of the skeleton of the elephant, and it is stated that the director of the national museum is in correspondence with Mr. Barnum with a view to prevent such a calamity, in which effort everybody wishes him success. Reference was made in the letter of two weeks ago to the large acquisitions of the museum through the New Orleans exposition. The curators of the various departments are getting some of these collections into shape, and although they are in some instances embarrassed by lack of space, some effective displays will be made. A very valuable, and, in some respects, typical collection was presented by the Japanese government, and has just been unpacked. It is intended to present an epitome of the arts and industries of the country, and as such it will doubtless be kept together for some time, and conspicuously displayed. It includes illustrations of the handicraft of the ingenious natives of Japan in pottery, porcelain, lacquer, bronze, silver, and copper, and also models and water-color sketches illustrating Japanese fisheries, domestic occupations and the like. Z.

Washington, D. C., Oct. 19.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

An attempt to photograph the corona.

Mr. W. H. Pickering having courteously sent me a copy of *Science* (August 14), containing an article entitled 'An attempt to photograph the solar corona without an eclipse,' may I ask you to insert the few lines which follow in the next number of your journal?

Passing by all those points which are covered, directly or indirectly, by my reply to Mr Pickering's first letter (*Science*, April 3), I find only two matters which I consider it necessary to notice.

1. Mr. Pickering says: "The inferiority of the best gelatine plates to the human eye in this respect [small differences of light] is very readily shown by an attempt to photograph distant mountains." He then goes on to say: "Another illustration of the same thing is the impossibility of photographing the moon in the daytime, when the sun is high above the horizon. Although the moon may be perfectly distinct to the eye, the negative shows no trace of it."

To your scientific readers, the reasons will readily suggest themselves, why, in the case of the moon in the daytime at some angular distance from the sun, the eye has an advantage over the plate, while, in the case of the corona, the plate has a great advantage over the eye. Apart from any such considerations, as a matter of fact, *there is no difficulty in photographing the moon at noonday.* Yesterday I took, with the apparatus used on the corona, four negatives on bromide plates (Edward's), between 11.30 A.M. and noon, in full sunshine. On all the plates, the moon is very distinct and well-defined. The moon at noonday, unless too near the sun, is an easier object to photograph than the corona. It is obvious, therefore, that photographic methods, which are not delicate enough for the moon, must utterly fail if applied to an object still more difficult, as the corona undoubtedly is at ordinary elevations.

If Mr. Pickering's statement of the 'impossibility' of photographing the moon under the conditions already named, rests upon his own experiments, some light may come upon a point which has occasioned me surprise, namely, that Mr. Pickering does not appear to get upon his plates the defects of his own apparatus; for example, those of the position of his shutter and those of his spectacle lens. In some experiments I made with a shutter similarly placed, very strong diffraction effects appeared on the plates, effects stronger than any photographic action which could be supposed to be due to the corona.

2. With regard to Mr. Pickering's experiments, I would point out that the conclusion to which they lead him, namely, "It therefore seems that even in the clearest weather the reflected light of the atmosphere is 300 times too strong to obtain the faintest visible image of the true coronal rays," appears to me to be irreconcilable with the direct observations of Professor Langley and others of the planets Mercury and Venus, as black disks before they reach the sun. Professor Young says: "Of course this implies behind the planet a background (of corona) of *sensible* brightness in comparison with the illumination of our atmosphere." (The sun, p. 229.)

The Bakerian lecture read recently before the Royal society, in which I have discussed some of these points more fully, will be in print in a few weeks. The photographic method is now being tried at the Cape of Good Hope, under the scientific conditions I have pointed out as essential, by Mr. Ray Woods, under the able superintendence of Dr. Gill, F.R.S. WILLIAM HUGGINS.

From the above interesting communication by Dr. Huggins I regret to find that he has failed to see my reply published in *Science*, for April 29, to his letter of April 13. My experiments on the position of the drop-shutter were there taken up with some detail. Also other points presumably referred to in the beginning of his article are discussed.

As to the observations of the planets Mercury and Venus, as black disks before they reach the sun; the

explanation usually given [1] of this phenomenon is that it is due to the refraction of the sun's rays passing through their atmospheres, and thus illuminating rather more than one hemisphere at a time. Any small body surrounded by a ring of light would naturally appear darker by contrast than the surrounding background.

In regard to photographing the moon in the daytime, it may be as well to call attention first to the fact, that as the moon and sky are nearly of the same brilliancy, and there are accordingly no irradiation effects, it is not a question of the best form of apparatus, but almost entirely of the contrast qualities of the plate and developer employed. In fact an ordinary camera furnished with a long focussed landscape lens is as good an instrument as can be devised for this investigation. Fortunately I had on hand some of Edwards's bromide plates, imported last June, and they, together with some Carbutt B. and Anthony chloride plates, were employed in the following determinations.

It should also be stated in regard to my remark, reading "the impossibility of photographing the moon in the daytime, when the sun is high above the horizon," that this was merely a general statement, founded on observations made in June and July when the sun's altitude in the middle of the day was between 60° and 70°.

Dr. Huggins has now shown that this statement is not rigidly exact, as with the sun at an altitude of 35°, and the moon in the most favorable position at this season (the third quarter), he has obtained a distinct image upon his plates. I repeated his experiment, October 16 and 17, when the moon was in the first quarter, and with the sun at an altitude of 18° obtained a similar result. The images, though distinct, were far too faint to print, and only two plates out of nine showed any image at all, although the moon was very conspicuous to the eye. I should consider it doubtful if photographs of the moon could be obtained with the sun at an altitude of over 60°. If then there is difficulty in obtaining an impression of the moon at 90° distance from the sun, how much more difficult would it be to photograph the still fainter coronal rays, when masked by the dazzling brilliancy of our atmosphere in the sun's immediate neighborhood.

But what particularly interested me in Dr. Huggins's communication was, that I saw at once that it furnished me a new constant, and accordingly a new method, for determining the relative light of the atmosphere near the sun, and the corona. Five separate measurements were made between 1.15 and 4.15 on October 16 and 17, of the relative light of the sky in the immediate vicinity of the sun and moon, by the photographic method described in a previous paper.[2] These ratios varied from 16, when the sun was highest, to 50 at the later hour. Taking the average of these values, we may safely assume that between three and four o'clock, when my successful pictures of the moon were taken, the light about the sun is generally not far from 35 times as bright as the light of the sky in a region where it is just possible to photograph the moon. But according to the observation of Prof. S. P. Langley, previously quoted, the light of the moon is ten times that of the corona at 3′ distance from the sun. Accordingly the light of the atmosphere in the immediate vicinity of the sun would have to be reduced 350 times in order to obtain an impression of the corona upon our plates. If the sun were at a greater altitude, this figure would be somewhat smaller. The value found by my previous experiments was 320. The closeness of the coincidence is probably accidental, but of the two methods the first one seems to me rather the more accurate.

WM. H. PICKERING.

[1] Newcomb's Astronomy, p. 299. [2] *Science*, Aug. 14.

Voss-Holtz electrical machine.

In response to Mr. Eaton's communication in *Science*, No. 141, I would say that, about a year ago, I compiled for one of my classes a discussion of the Voss-Holtz electrical machine. Some months afterward Mr. E. B. Benjamin prepared a pamphlet regarding his machines, and asked my permission to incorporate what I had given my students regarding the theory of these. I granted his request, though not satisfied with the completeness of the discussion. What I had written had not been intended as a contribution to science, and I did not deem it of sufficient importance to quote authorities. Before putting my compilation on paper, I had consulted Ferguson, Silvanus Thompson, Ganot, Desehanel, some articles by Dr. Atkinson of Chicago, and the article in *Science* by Mr. H. W. Eaton. I cheerfully express my obligation to all of these writers. Mr. Eaton's article was specially helpful. As I claimed no originality, there was no attempt or wish to deprive him of any credit due.

The greater part of Mr. Benjamin's pamphlet was written by himself. W. LE C. STEVENS.

Brooklyn, Oct. 19.

Recent Proceedings of Societies.

Academy of natural sciences, Philadelphia.

Botanical section, Oct. 12.—Mr. Aubrey H. Smith described the flowering of Gordonia pubescens in Bartram's garden and gave a history of the species.—Mr. John Redfield spoke of the topographical features of Martha's vineyard and Nantucket, in connection with the flora of those islands. The northern part of the former rises into rounded gravelly hills of considerable elevation, composed of gravel drift, with occasional large bowlders. They are evidently of glacial origin. The more central portion consists of level plains of gravel covered with oak, mostly Quercus obtusiloba. The general character of the flora is much like that found on the summit of the divides in southern New Jersey, though much more limited as to species. Farther south, extensive ponds both of fresh and salt water introduce their characteristic vegetation. In Nantucket he had found the gravelly hills of much less height, the greater portion of the island consisting, in fact, of treeless plains. One extensive grove of Pinus rigida exists in the central portion, and is known to have been planted. The most characteristic plants of the plains seemed to be bear-berry, Arctostaphylos uva-ursi, which grows there in great profusion. The two species of Hudsonia abound, the Hericoides being seen everywhere, and less frequently the bluish tufts of H. tomentosa, Polygalae polygama, Myrica, cerifera, and various vaccinæ abound. He saw many large patches of Corema Conradii, the existence of which in Nantucket had first been made known by Mrs. Owen of Springfield, Mass. But the most inter-